



TITLE:

<Preliminary>Characterization of Xyloglucan Endotransglycosylation in Suspension-cultured Poplar Cells

AUTHOR(S):

TAKEDA, Takumi; MITSUISHI, Yasushi; SAKAI, Fukumi; HAYASHI, Takahisa

CITATION:

TAKEDA, Takumi ...[et al]. <Preliminary>Characterization of Xyloglucan Endotransglycosylation in Suspension-cultured Poplar Cells. Wood research : bulletin of the Wood Research Institute Kyoto University 1995, 82: 14-16

ISSUE DATE:

1995-09-30

URL:

<http://hdl.handle.net/2433/53239>

RIGHT:

Characterization of Xyloglucan Endotransglycosylation in Suspension-cultured Poplar Cells

Takumi TAKEDA*², Yasushi MITSUISHI*³,
Fukumi SAKAI*² and Takahisa HAYASHI*²

(Received May 31, 1995)

Keywords : Xyloglucan endotransglycosylase, Xyloglucan oligosaccharide, *Populus alba* L.

Abbreviations : XXXG, heptasaccharide (glucose/xylose, 4:3); XXXGXXXG, tetradecanosaccharide (glucose/xylose, 8:6); XXXGXXXGXXXG, hendecanosaccharide (glucose/xylose, 12:9); XXXGXXXGXXXGXXXG, (glucose/xylose, 16:12).

Introduction

Xyloglucan endotransglycosylases occur widely in higher plants¹⁾, where the enzyme activities catalyze the transfer of a part of one xyloglucan to the other xyloglucan (oligosaccharides). The activities are closely related to various physiological aspects of plant growth, such as seed germination^{2,3)}, cell expansion⁴⁾, GA3-related elongation⁵⁾, somatic embryogenesis⁶⁾, and fruit ripening⁷⁾. The question is specifically whether xyloglucan endotransglycosylase in poplar cells are responsible for xyloglucan degradation or xyloglucan rearrangement in the cell wall. It is necessary to characterize the dominant reaction for xyloglucan endotransglycosylases in suspension-cultured poplar cells. This paper describes the properties of xyloglucan endotransglycosylase in suspension-cultured poplar cells and the changes of the enzyme activity during growth.

Results and Discussion

Xyloglucan endotransglycosylase activities in suspension-cultured poplar cells were determined by the quantity of ³H-xyloglucan formed by the transfer of a part of large xyloglucan molecule to [³H]-XXXGol. The specificity of acceptor was studied using

*¹ A part of work was presented at the Japanese Society of Plant Physiologists, Tukuba, March, 1994 the Japan Wood Research Society in Nara, April, 1994.

*² Laboratory of Gene Expression.

*³ National Institute of Bioscience and Human Technology, AIST, Ibaraki, 305, Japan.

*⁴ This work was supported in part by grants from the Toray Science Foundation and from the Ministry of Education, Science and Culture, Japan.

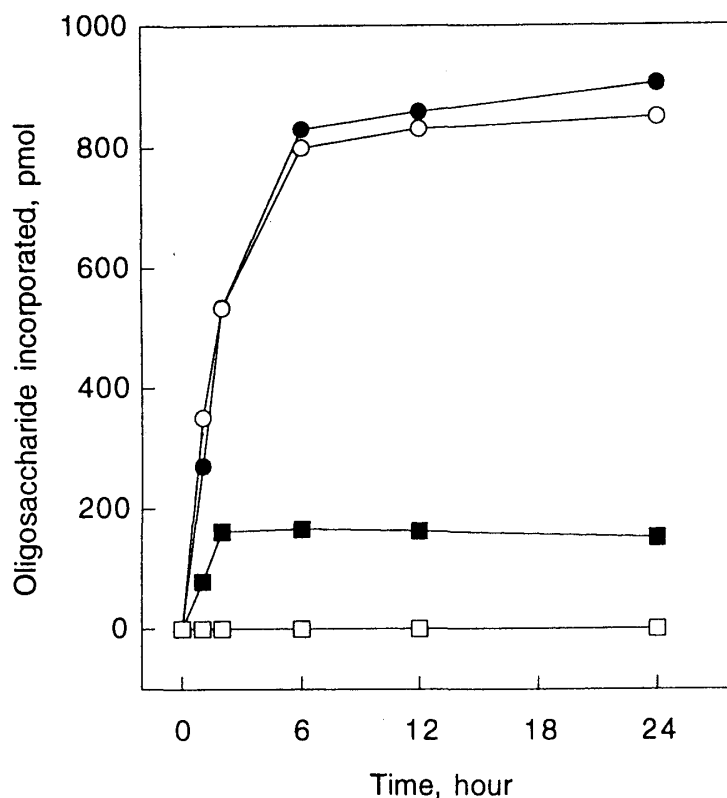


Fig. 1. Time course of xyloglucan endotransglycosylation with oligosaccharides using XXXGol (●) and XXXGXXXGol (○) and XXXGXXXGXXXGol (■) and XXGXXXGXXXGXXXGol (□) as acceptor. The concentration of each oligosaccharide was at 200 μ M.

alternative xyloglucan molecule such as ^3H -monomer (XXXGol), ^3H -dimer (XXXGXXXGol), ^3H -trimer (XXXGXXXGXXXGol) and ^3H -tetramer (XXXGXXXGXXXGXXXGol) of heptasaccharide (Fig. 1). The quantity of ^3H -xyloglucan formed by the ^3H -monomer and ^3H -dimer increased in proportion to the reaction time within 6 h. But the ^3H -trimer and ^3H -tetramer were completely ineffective as acceptor. Though the concentration of each acceptor was varied in the reaction mixture, high molecular sizes of acceptor such as ^3H -trimer and ^3H -tetramer were ineffective. These results show that xyloglucan endotransglycosylase transfers xyloglucan to low molecular xyloglucan oligosaccharides. It was suggested that the xyloglucan endotransglycosylase may appear to function for the degradation of xyloglucan rather than rearrangement of xyloglucan.

Plant hormones such as 2,4-D and benzyladenine, abscisic acid, gibbererin, brasinolide, ethylene did not enhance the enzyme activity during the early stage of growth.

The activity of xyloglucan endotransglycosylase markedly increased at the exponential growth and decreased immediately at the stationary phase of cells in presence of 2,4-D (Fig. 2). The enzyme activity is not evoked by 2,4-D but increased and then decreased during

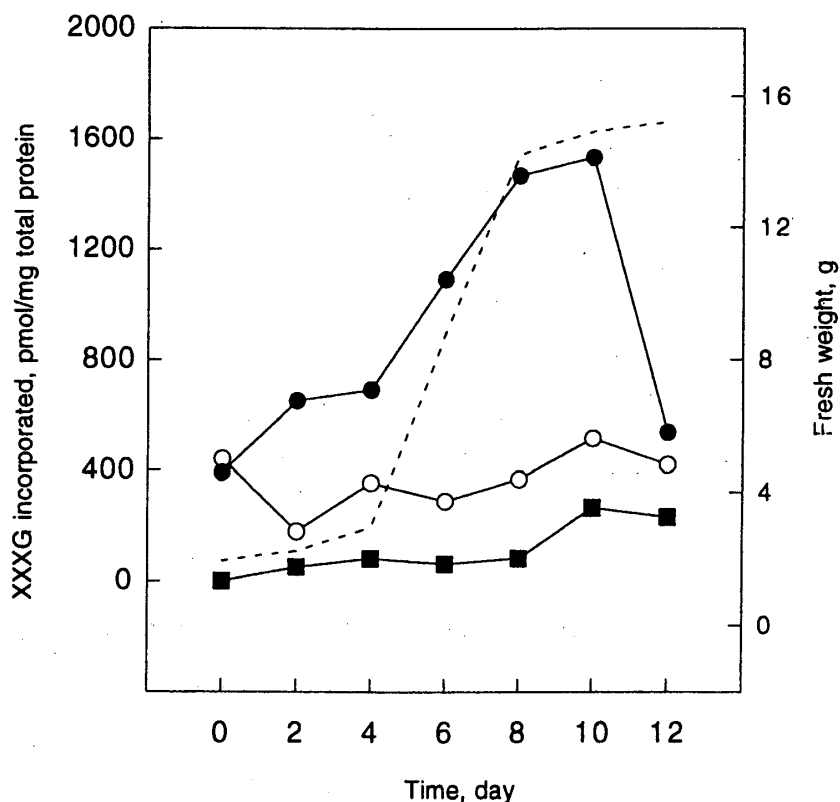


Fig. 2. Changes of xyloglucan endotransglycosylase activity during cell growth. The cells were grown in shaker flasks in the MS medium containing $10 \mu\text{M}$ 2, 4-D. On the days indicated, cells were harvested for determination of xyloglucan endotransglycosylase activity in buffer-soluble (○) and buffer-insoluble (●); extracellular fraction (■).

cell development in the presence of 2, 4-D. These results suggested that the activity of xyloglucan endotransglycosylase is developmentally regulated during normal cell growth.

References

- 1) S.C. FRY, R.C. SMITH, K.F. RENNICK, D.J. MARTIN, S.K. HODGE and K.J. MATTEWS: *J. Biochem.*, **282**, 821-828 (1992).
- 2) V. FARKAS, E. SULOVA, R. HANNA and G. MACLACHLAN: *Arch. Biochem. Biophys.*, **298**, 365-370 (1992).
- 3) C. FANUTTI, M.J. GIDLEY and J.S.G. REID: *Plant J.*, **3**, 691-700 (1993).
- 4) S.C. FRY: *Planta*, **169**, 443-453 (1986).
- 5) I. POTTER and S.C. FRY: *Ibid.*, **103**, 235-241 (1993).
- 6) P.R. HETHERINGTON and S.C. FRY: *Ibid.*, **103**, 987-992 (1993).
- 7) R.J. REDGWELL and S.C. FRY: *Ibid.*, **103**, 1399-1406 (1993).